ΕΝΔΕΙΚΤΙΚΕΣ ΑΠΑΝΤΗΣΕΙΣ

ΦΥΣΙΚΗ ΚΑΤΕΥΘΥΝΣΗΣ Γ΄ΛΥΚΕΙΟΥ

ΠΑΝΕΛΛΗΝΙΕΣ 2015

ΘΕΜΑ Α

Α1. α

Α2. β

Α3. α

Α4. δ

Α5. **α.** Λ

β. Σ

γ. Σ

δ. Λ

ε. Σ

ΘΕΜΑ Β

Β1. iii

$$I_A = I_\rho + I_1 = \frac{1}{3}Ml^2 + ml^2 = \frac{5}{6}Ml^2$$

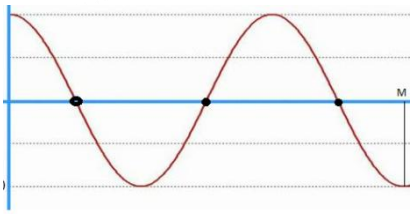
$$\Sigma\tau_A = I_A \cdot \alpha_\gamma \Rightarrow W \cdot \frac{l}{2} + W_1 \cdot l = \frac{5}{6}Ml^2 \cdot \alpha_\gamma \Rightarrow \alpha_\gamma = \frac{6g}{5l}$$

$$\frac{\Delta L_\rho}{\Delta t} = I_\rho \cdot \alpha_\gamma = \frac{1}{3}Ml^2 \cdot \frac{6g}{5l} = \frac{2}{5} \cdot M \cdot g \cdot l$$

Β2. iii

$$x_M = \lambda + \frac{\lambda}{4} + \frac{\lambda}{12} = \frac{4\lambda}{3}$$

$$A'_M = 2A \cdot \left|\sigma\upsilon\nu\, 2\pi \cdot \frac{x_M}{\lambda}\right| = 2A \cdot \left|\sigma\upsilon\nu\, \frac{8\pi}{3}\right| = A$$



Β3. **(**i**)**

$$D_2 = m_2 \cdot \omega^2 = m_2 \cdot \frac{k}{m_1 + m_2}$$

Θέτω θετική φορά προς τα πάνω για το Σ_2:

$$\Sigma F_x = -D_2 \cdot x \Rightarrow N - W_{2x} = -D_2 \cdot x$$

Στην πάνω ακραία θέση ($x = +A$):

$$N - m_2 \cdot g \cdot \eta\mu\phi = -\frac{m_2 \cdot k}{m_1 + m_2} \cdot A \Rightarrow N = m_2 \cdot g \cdot \eta\mu\phi - \frac{m_2 \cdot k \cdot A}{m_1 + m_2}$$

Πρέπει $N > 0 \Rightarrow$

$$\Rightarrow m_2 \cdot g \cdot \eta\mu\phi - \frac{m_2 \cdot k \cdot A}{m_1 + m_2} > 0 \Rightarrow m_2 \cdot g \cdot \eta\mu\phi > \frac{m_2 \cdot k \cdot A}{m_1 + m_2} \Rightarrow$$
$$\Rightarrow k \cdot A < (m_1 + m_2) \cdot g \cdot \eta\mu\phi$$

ΘΕΜΑ Γ

Γ1.

$$E_T = U_{E\max} \Rightarrow 8 \cdot 10^{-2} = \frac{1}{2} C \cdot V^2 \Rightarrow C = 10^{-4}\ F$$

Άρα $T = 2\pi \cdot \sqrt{LC} \Rightarrow T = 8\pi \cdot 10^{-3}\ s$

Γ2.

$$\left.\begin{aligned} q &= Q \cdot \sigma\upsilon\nu \frac{2\pi}{T} \cdot \frac{T}{12} = Q \cdot \sigma\upsilon\nu \frac{\pi}{6} \\ Q &= C \cdot V \Rightarrow Q = 4 \cdot 10^{-3}\ C \end{aligned}\right\} \Rightarrow q = 2 \cdot \sqrt{3} \cdot 10^{-3}\ C$$

$$U_E = \frac{q^2}{2C} \Rightarrow U_E = 0{,}06\ J$$

$$\left.\begin{aligned} q &= Q \cdot \sigma\upsilon\nu\omega t \\ i &= -Q\omega \cdot \eta\mu\omega t \rightarrow \frac{di}{dt} = -Q\omega^2 \cdot \sigma\upsilon\nu\omega t = -\omega^2 \cdot Q \cdot \sigma\upsilon\nu\omega t \end{aligned}\right\} \Rightarrow \frac{di}{dt} = -\omega^2 \cdot q$$

Γ3.

$$\left.\begin{aligned} U_E &= 3U_B \\ U_E + U_B &= U_{E\max} \end{aligned}\right\} \Rightarrow |q| = 2\sqrt{3} \cdot 10^{-3}\ C$$

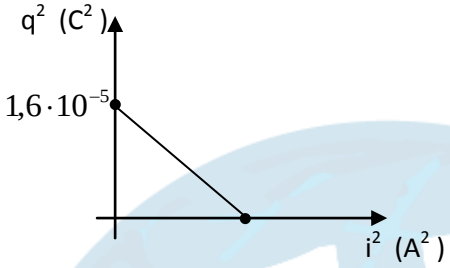
$$\left|\frac{di}{dt}\right| = \omega^2 \cdot q \Rightarrow \left|\frac{di}{dt}\right| = 125\sqrt{3}\ \ A/s$$

Γ4.

$$U_E + U_B = E_T$$

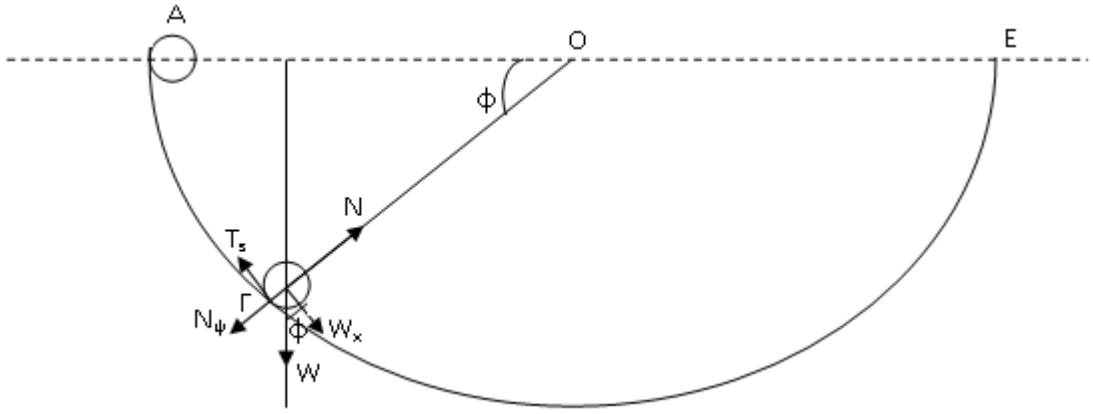
$$\frac{q^2}{2C} + \frac{1}{2} L \cdot i^2 = E_T \Rightarrow 5 \cdot 10^3 \cdot q^2 + 8 \cdot 10^{-2} \cdot i^2 = 8 \cdot 10^{-2} \Rightarrow$$

$$\Rightarrow q^2 = 1{,}6 \cdot 10^{-5} - 1{,}6 \cdot 10^{-5} \cdot i^2 \quad (SI)$$



ΘΕΜΑ Δ

Δ1.



$$\Sigma F_x = m \cdot \alpha_{cm} \Rightarrow W - T_s = m \cdot \alpha_{cm} \Rightarrow m \cdot g \cdot \sigma\upsilon\nu\phi - T_s = m \cdot \alpha_{cm} \quad (1)$$

$$\Sigma \tau = I \cdot \alpha_\gamma \Rightarrow T_s \cdot r = \frac{2}{5} m \cdot r^2 \cdot \alpha_\gamma \overset{r \cdot \alpha_\gamma = \alpha_E = \alpha_{cm}}{\Rightarrow} T_s = \frac{2}{5} m \cdot \alpha_{cm} \quad (2)$$

Από (1) και (2) προκύπτει $T_s = 4\sigma\upsilon\nu\phi$

Δ2.

$OK = R - \frac{R}{8} = \frac{7R}{8}$

Α → Γ: **Α.Δ.Μ.Ε**

$$U + K = U' + K' \Rightarrow$$

$$\Rightarrow m \cdot g \cdot OK \cdot \eta\mu\phi + 0 = 0 + \frac{1}{2} I \cdot \omega^2 + \frac{1}{2} m \cdot \upsilon^2 \Rightarrow$$

$$\Rightarrow m \cdot g \cdot \frac{7R}{8} = \frac{1}{2} \cdot \frac{2}{5} m \cdot r^2 \cdot \omega^2 + \frac{1}{2} m \cdot \upsilon^2 \Rightarrow$$

$$\Rightarrow \frac{7gR}{8} \cdot \frac{1}{2} = \frac{1}{5} \cdot \upsilon^2 + \frac{1}{2} \cdot \upsilon^2 \Rightarrow$$

$$\Rightarrow \frac{7gR}{16} = \frac{7\upsilon^2}{10} \Rightarrow \upsilon^2 = \frac{5gR}{8} \quad (1)$$

Στο Γ

$$\Sigma F_{\Psi} = F_K \Rightarrow N - W_{\Psi} = \frac{m \cdot \upsilon_{\Gamma}^2}{OK} \Rightarrow$$

$$\Rightarrow N = m \cdot g \cdot \eta\mu\phi + \frac{m \cdot \upsilon_{\Gamma}^2}{OK} \overset{(1)}{\Rightarrow} N = \frac{17}{14} \cdot m \cdot g \Rightarrow N = 17\,N$$

Δ3.

Δ → Ε: **Α.Δ.Μ.Ε (**Ορίζουμε επίπεδο $U_W = 0$ στο Δ**)**

$$U_{\Delta} + K_{\Delta} = U_{\Epsilon} + K_{\Epsilon} \Rightarrow$$

$$\Rightarrow \frac{1}{2} m \cdot \upsilon_{\Delta}^2 + \frac{1}{2} \cdot \frac{2}{5} m \cdot r^2 \cdot \omega^2 = m \cdot g \cdot \frac{7R}{8} + \frac{1}{2} m \cdot \upsilon_E^2 + \frac{1}{2} \cdot \frac{2}{5} m \cdot r^2 \cdot \omega^2 \Rightarrow$$

$$\Rightarrow \upsilon_E = 4m/s$$

Ε → Ζ: $\Sigma\tau = 0 \Rightarrow \alpha_{\gamma} = 0 \Rightarrow \omega = \sigma\tau\alpha\theta\varepsilon\rho\acute{o}$

Ζ: το ανώτατο σημείο που φτάνει το σώμα

Ορίζουμε επίπεδο $U_W = 0$ στο Ε

Α.Δ.Μ.Ε

$$U_E + K_E = U_Z + K_Z \Rightarrow$$

$$\Rightarrow 0 + \frac{1}{2} I \cdot \omega^2 + \frac{1}{2} m \cdot \upsilon_E^2 = m \cdot g \cdot h + \frac{1}{2} I \cdot \omega^2 \Rightarrow$$

$$\Rightarrow h = 0{,}8\,m$$

$$H = 1{,}6 + 0{,}8 = 2{,}4\,m$$

Δ4.

$$\frac{dL}{dt} = \Sigma\tau = W \cdot 0 = 0$$

$$\frac{dK}{dt} = \frac{dK_{\pi}}{dt} + \frac{dK_{\mu}}{dt} = \Sigma F \cdot \upsilon = -m \cdot g \cdot \upsilon_{cm} \overset{\frac{dK_{\pi}}{dt}=0}{\Rightarrow} \frac{dK}{dt} = -56\, J/s$$